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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/990,397	11/20/2001	Jung-Yu Hsieh	JCLA7289	2785

7590 06/16/2004

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EXAMINER	
LEWIS, MONICA	
ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 06/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/990,397	HSIEH ET AL.	
	Examiner	Art Unit	
	Monica Lewis	2822	

-- The MAILING DATE of this communication appears on th cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 4-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 4-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is in response to the election filed March 31, 2004.

Election/Restrictions

2. Applicant's election without traverse of Embodiment I in the reply filed on 3/31/04 is acknowledged.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 4 and 5 are rejected under 35 U.S.C. 103(a) as obvious over Joo (U.S. Publication No. 2001/0044187) in view of Bui (U.S. Patent No. 6,163,049), Park et al. (U.S. Publication No. 2001/0014510) and Fang et al. *The Electronic Structure of Tantalum (oxy)nitrides TaON and* Ta_3N_5.

In regards to claim 1, Joo et al. ("Joo") discloses the following:

a) a tunneling oxide layer (20) located upon a substrate (10) (For Example: See Figure 2);

b) a floating gate (30) located upon the tunneling oxide layer (For Example: See Figure 2);

c) a first oxide layer (32) located upon the floating gate (For Example: See Figure 2);

d) a high dielectric constant dielectric layer (40) located upon the first oxide layer (For Example: See Figure 2);

e) a second oxide layer (42), located upon the high dielectric constant dielectric layer, wherein, together with the first oxide layer and the high dielectric constant dielectric layer, a dielectric stacked layer is formed (For Example: See Figure 2); and

f) a control gate (50) formed on the second oxide layer of the dielectric stacked layer (For Example: See Figure 2).

In regards to claim 1, Joo fails to disclose the following:

a) a source/drain region located in the substrate on the two sides of the floating gate.

However, Bui discloses a source/drain formed in the substrate (For Example: See Figure 1 and Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo to include a source/drain in the substrate as disclosed in Bui because that is the structure that flash memory normally comprises (For Example: See Column 1 Lines 5-27).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

b) dielectric constant of the high dielectric constant layer is greater than 8 and a band gap value of the high dielectric constant dielectric layer is less than a band gap value of silicon oxide.

Although, Joo does not specifically disclose that the dielectric constant layer is greater than 8, it is well known than TaON has a dielectric constant over 25 (For Example: See Park et al. Paragraph 8). Additionally, Joo does not specifically disclose that the band gap value of the high dielectric constant dielectric layer is less than a band gap value of silicon oxide, however it is well known than TaON has a band gap value less than silicon oxide (For Example: See Fang et al. Page 1248).

Finally, although the prior art does not specifically disclose that the band gap of the high dielectric constant dielectric layer is less than a band gap value of silicon oxide this limitation is seen to be an inherent when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions presumed to be inherent. In re Best, 562 F.2d 1252, 1254, 195 USPQ 430, 433 (CCPA 1977).

In regards to claim 4, Joo fails to disclose the following:

a) the high dielectric constant dielectric layer is a single layer including one material selected from the group consisting of $A1_2O_3$, Y_2O_3, $ZrSi_xO_y$, $HfSi_xO_y$, La_2O_3, ZrO_2, HfO_2, Ta_2O_5, Pr_2O_3 and TiO_2.

However, Bui discloses a dielectric layer composed of aluminum oxide, which has a dielectric constant greater than 10 (For Example: See Abstract and Column 4 Line 35). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo to include an aluminum oxide as disclosed in Bui because it aids in maintaining the capacitance of the ONO film (For Example: See Abstract).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

In regards to claim 5, Joo fails to disclose the following:

a) the high dielectric constant dielectric layer is a layer including a mixed material any one selected from the group consisting of $A1_2O_3$, Y_2O_3, $ZrSi_xO_y$, $HfSi_xO_y$, La_2O_3, ZrO_2, HfO_2, Ta_2O_5, Pr_2O_3 and TiO_2.

However, Bui discloses a dielectric layer composed of aluminum oxide, which has a dielectric constant greater than 10 (For Example: See Abstract and Column 4 Line 35). It would have been obvious to one having ordinary skill in the art at the time the invention was made to

modify the semiconductor device of Joo to include an aluminum oxide as disclosed in Bui because it aids in maintaining the capacitance of the ONO film (For Example: See Abstract).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

5. Claim 6 is rejected under 35 U.S.C. 103(a) as obvious over Joo (U.S. Publication No. 2001/0044187) in view of Bui (U.S. Patent No. 6,163,049), Park et al. (U.S. Publication No. 2001/0014510), Fang et al. *The Electronic Structure of Tantalum (oxy)nitrides TaON and* Ta_3N_5 and Choi et al. (U.S. Patent No. 6,340,827)

In regards to claim 6, Joo fails to disclose the following:

a) the material of the high dielectric constant dielectric layer is a stacked layer, each layer of the stacked layer including one selected from the group consisting of Al_2O_3, Y_2O_3, $ZrSi_xO_y$, $HfSi_xO_y$, La_2O_3, ZrO_2, HfO_2, Ta_2O_5, Pr_2O_3 and TiO_2.

However, Choi et al. ("Choi") discloses a dielectric layer composed of a variety of compounds (For Example: See Column 4 Lines 52-67). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo to include a dielectric layer composed of a variety of compounds as disclosed in Choi because it aids in preventing the diffusion of oxygen (For Example: See Abstract).

Additionally, since Joo and Bui are both from the same field of endeavor, the purpose disclosed by Bui would have been recognized in the pertinent art of Joo.

Response to Arguments

6. Applicant's arguments filed 3/31/04 have been fully considered but they are not persuasive. First, Applicant argues that "it is noted that Joo teaches the silicon nitride/high dielectric constant dielectric layer/silicon nitride (NHN), with the high dielectric constant

dielectric layer sandwiched between two silicon nitride layers as a composite film stack. However, claim 1 of the invention disclosed an inter-gate dielectric film comprising a first oxide layer, a high dielectric constant dielectric layer and a second oxide layer, but not including a high dielectric constant dielectric layer sandwiched between two silicon nitride layers." During patent examination, the claims are given the broadest reasonable interpretation consistent with the specification. See In re Morris, 127 F.3d 1048, 44 USPQ2d 1023 (Fed. Cir. 1997). Claim 1 discloses "a first oxide layer" and Joo discloses a first oxide layer (32) which is SiON (See Paragraph 52). There is nothing disclosed in the claim that states that the oxide layer cannot be comprised of other materials. Therefore, SiON is the first oxide layer.

Finally, Applicant argues that the "combination of Joo, Park and Bui would dissuade one of ordinary skill in the art from arriving at the present invention." In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor device of Joo to include a source/drain in the substrate as disclosed in Bui because that is the structure that flash memory normally comprises and Park was utilized to show that it is well known that TaON has a dielectric constant is over 25. Therefore, the combination does not keep one of ordinary skill in the art from arriving at the present invention.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 571-272-1838. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ML
June 12, 2004

Mary Wilczewski
Primary Examiner